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International Conference on

RECYCLING AND EARTH SCIENCE

OCTOBER 21-22, 2024 ROME | ITALY

SCIENTIFIC PROGRAM

DAY 1 OCTOBER 21, 2024

08:30-09:30 | Registration Desk Opens

09:30-10:00 | Opening Ceremony & Inaugural Address

KEYNOTE FORUM

10:00-10:45	**Tsai Chi Kuo,** National Taiwan University of Science and Technology, Taiwan Title: Using random forest to improve production efficiency and environmental impact reduction

COFFEE BREAK | 10:45-11:00

Sessions : Recycling Innovations | Solid Waste Management | Circulatory Economy | Climate Change | Green Energy | Geophysics and Geochemistry | Upcycling | Environmental Sustainability and Development | Renewable Energy | Climate Resilience | Paper Recycling | Atmospheric Chemistry

Chair: Tsai Chi Kuo, National Taiwan University of Science and Technology, Taiwan

11:00-11:30	**Bastian Hansel,** Freiberg University of Mining and Technology, Germany Title: Early stage recovery of lithium from lithium-ion batterie black mass in pilot scale
11:30-12:00	**Alan Tupicoff,** Finding Other Solutions, Australia Title: Climate change influence our built environment
12:00-12:30	**Patricia Perez Llamas,** Institute of Energy Technology (ITE), Spain Title: Production of renewable hydrogen from non-recyclable urban and industrial textile waste
12:30-13:00	**Alessandro Stillo,** President of Rete ONU, Italy Title: Waste pickers: A huge way for reusing and recycling waste with social, economical and enviromental effect

LUNCH BREAK | 13:00-14:00

14:00-14:30	**Karina Corada-Pérez,** University of East London, UK Title: Green shields: The role of domestic gardens in enhancing air quality and thermal comfort
14:30-15:00	**George Odhiambo Ochuodho,** University of Nairobi-Kenya, Kenya Title: Mitigating the impacts of climate change by enhancing environmental sustainability and increased food security in Rural Africa
15:00-15:30	**Wensheng Fang,** Chinese Academy of Agricultural Sciences, China Title: Succession and reconstruction of soil microbial communities following fumigantion

15:30-16:00	**Yutong Ji,** Chinese Academy of Agricultural Sciences, China Title: Microbial regulation in biofumigation: Reducing soil-borne pest risks to boost cowpea yield
16:00-16:20| COFFEE BREAK	
16:20-16:50	**Xin Wang,** Chinese Academy of Agricultural Sciences, China Title: Fumigation enhances soil manganese availability by altering the structure of the manganese-oxidizing microbial community
16:50-17-20	**Hongyu Wang,** Chinese Academy of Agricultural Sciences, China Title: Synergistic effect of anaerobic bacteria Njyb-1 on soil anaerobic disinfection
NETWORKING AND AWARDS CEREMONY	
END OF DAY 1	

DAY-2 OCTOBER 22, 2024

Registration Desk Opens

Opening Ceremony & Inaugural Address

Sessions: Sustainable Materials Management | Industrial Waste Recycling | Metal and Plastic Recycling | Recycling Business and Marketing | Mitigation Measures | Remote Sensing & GIS Applications | Meteorology | Fossil Fuels | Earth Science | Climate Hazards

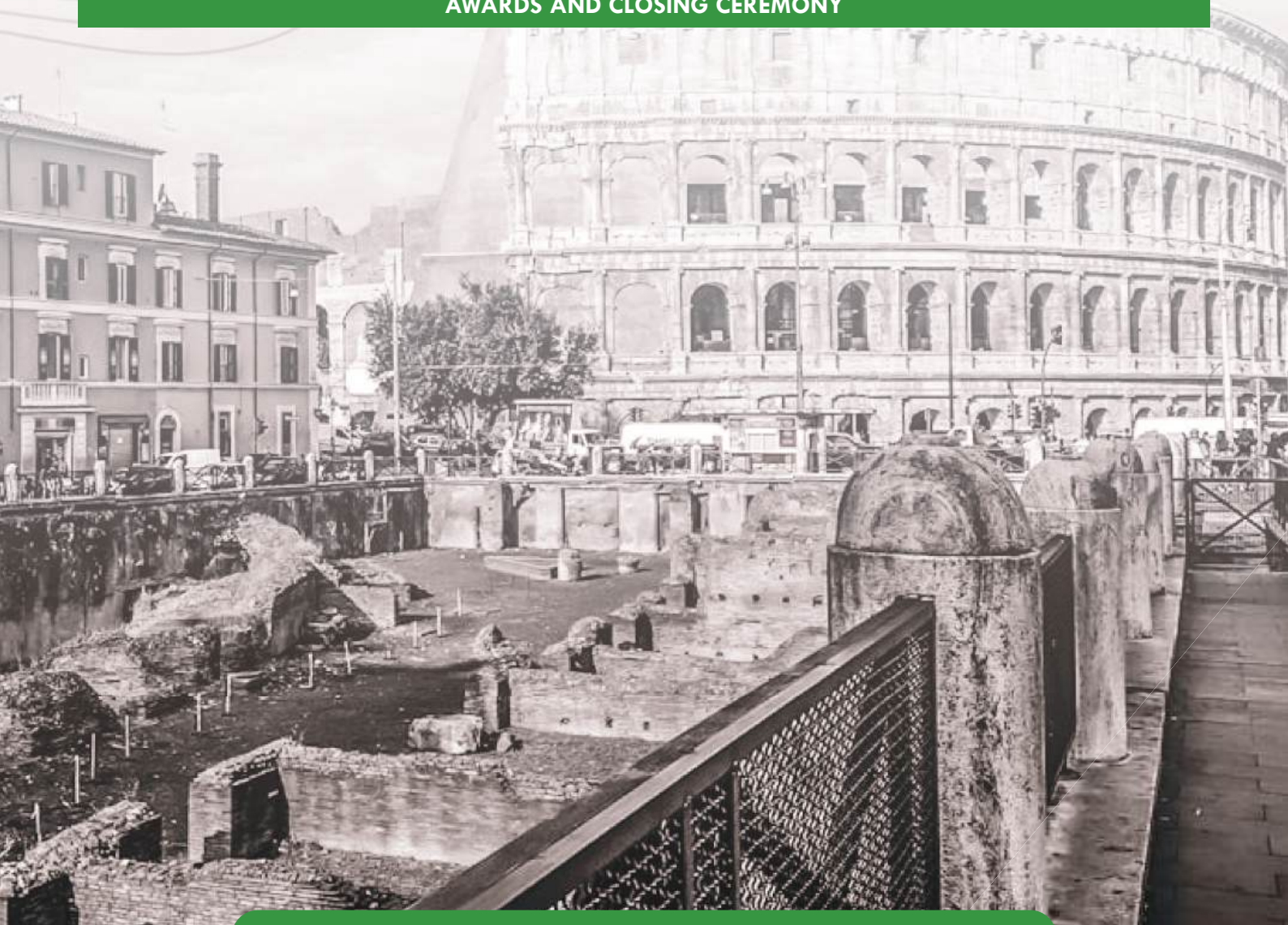
10:30-11:00	**Yoseph Arba Orke,** Arba Minch Water Technology Institute, Ethiopia Title: Green shields: The role of domestic gardens in enhancing air quality and thermal comfort
COFFEE BREAK | 11:00-11:15	
11:15-11:45	**Jean Paul Lange,** University of Twente, Netherlands Title: Recycling cascade for waste plastics
11:45-12:15	**Roger Achkar,** Global Waste Cleaning Network, UK Title: Rethinking plastics: Circular strategies for a greener future
12:15-12:45	**Thomas Valone,** Integrity Research Institute, USA Title: Trend analysis of the hansen three-variable climate graph as a predictive roadmap based on paleoclimatology
12:45- 13:45 | LUNCH BREAK	
13:45-14:15	**Nematullah Wafa,** RenewSphere, France Title: Global disparities in renewable energy implementation are obstacles to climate change mitigation

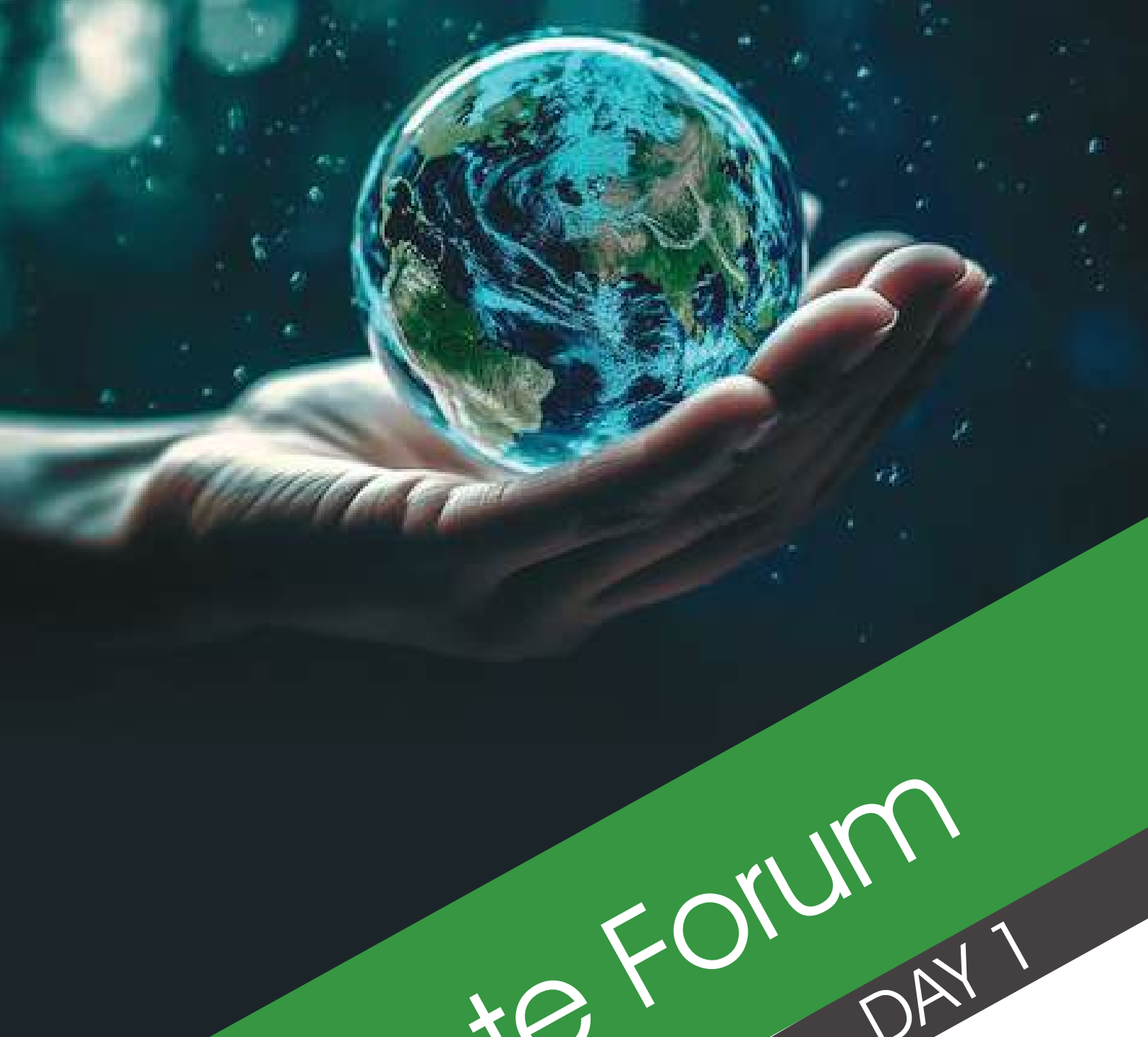
14:15-14:45	**Xinhua Chen,** Chinese Academy of Agricultural Sciences, China Title: Analysis of the key factors that influence the efficacy of metam sodium against soil-borne pests
14:45-15:15	**Rongjun Guo,** Chinese Academy of Agricultural Sciences, China Title: Microecological mechanism behind the alleviation of common bean root rot disease after 7-year continuous cropping
15:15- 15:45	**Sa Xiao,** Chinese Academy of Agricultural Sciences, China Title: Root-knot nematode infection promotes soil nutrient P transformation in Yam cultivation
COFFEE BREAK | 15:45-16:00	
16:00-16:30	**Yuan Li,** Chinese Academy of Agricultural Sciences, China Title: Effects of chloropicrin fumigation combined with biochar on soil bacterial and fungal communities
16:30-17:00	**Lorena De Medina Salas,** University of Veracruz, Mexico Title: Waste management and the circular economy in Mexico

POSTER SESSION @ MEETING ROOMS

PANEL DISCUSSION

AWARDS AND CLOSING CEREMONY





Keynote Forum

DAY 1

International Conference on

Recycling and Earth Science

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Using random forest to improve production efficiency and environmental impact reduction

Tsai Chi Kuo
National Taiwan University of Science and Technology, Taiwan

The challenge for the semiconductor industry is the high energy consumption and high environmental impact of the manufacturing process. The semiconductor industry is using more and more energy and other resources, and in the production process, it also uses many kinds of acid and alkaline solutions, organic solvents, special gases, etc. These chemicals may not only produce many environmental impacts, but also cause potential hazards to the workers. In the past, most of research only focus on the improvement of yield rate, few of them considers the reduction of energies and resources simultaneously. It highlights a research gap. To develop the systematic method, first, the hot spot manufacturing process of energy using is identified. The machine learning model is verified to reduce the yield rate and to improve its efficiency. If the model detects errors in the machine learning model during the production process, the process will be stopped immediately, which can effectively avoid the decline in yield rate, material waste, machine operation time, and environmental pollution. The system simulation is based on the basic queueing theory to calculate the number of wafers that may be produced in the system and the waiting time in the system. Finally, the reduction of material usage and production time is the improvement of efficiency, the life cycle assessment (LCA) is used to measure the reduction of environmental impacts.

Biography

Tsai Chi Kuo has completed his PhD at the age of 30 years from Texas Tech University. He is a professor of National Taiwan University of Science and Technology. He has published more than 100 papers in reputed journals and has been serving as an editorial board member of repute.

Recycling cascade for waste plastics

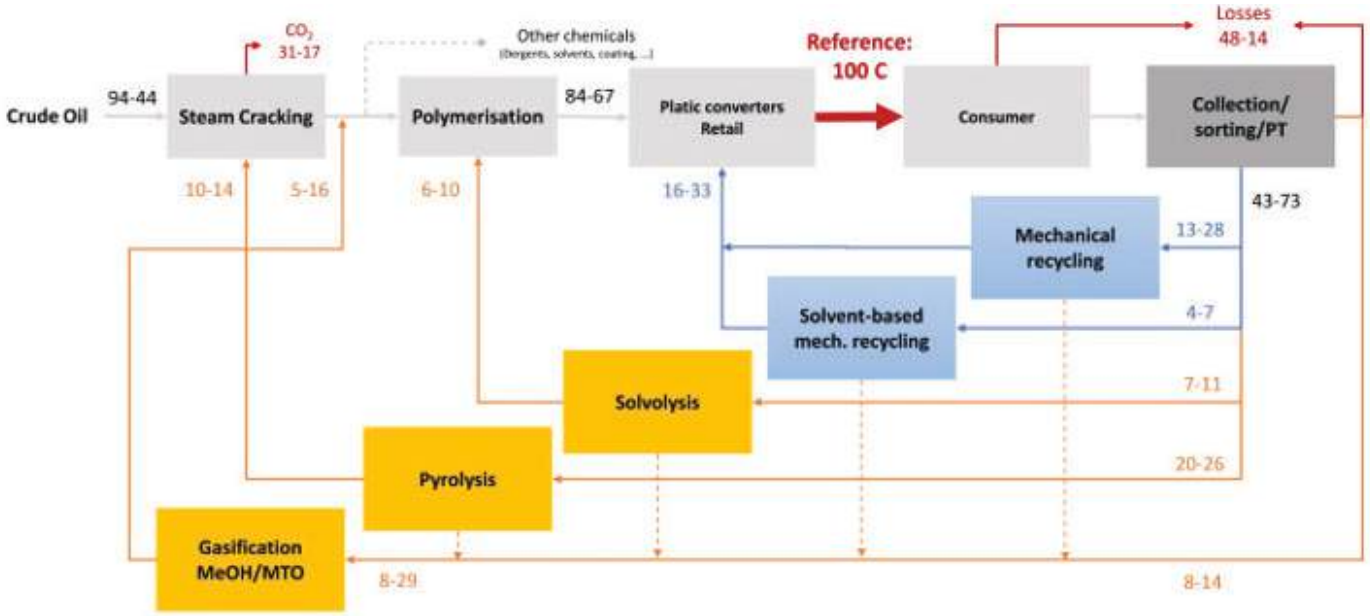
Jean-Paul Lange
University of Twente, The Netherlands

Public and politicians generally associate plastic recycling with closed-loop recycling, the recycling of one product to its equivalent. But a true circular carbochemical industry requires more than that. [1,2] It requires a cascade of technologies that complement each other to upgrade the largest possible fraction of spent carbon into all possible polymers, feed it to all possible chemical products and, thereby, substitute much of the fossil feedstock (Figure- 1). [3]

The cascade starts with mechanical recycling (Figure- 1, blue boxes) the waste streams of highest quality waste, preferably as closed-loop but also as open-loop to other products. Mechanically recycled resins generally need to be blended with virgin resins, likely not beyond 30 wt%, to mitigate the presence of impurities and inevitable chain degradation.

Recycling the more contaminated waste requires then to chemically convert the polymer chain to its constituting monomer, or to a versatile feedstock (Fig. 1, yellow boxes). For instance, polyesters and polyamides could be depolymerized back to their constituting monomers, whereas mixed polyolefins can be pyrolyzed to waxy hydrocarbons for feeding to a steam cracker. Mixed polymers, thermoplastics and thermosets, can be gasified to synthesis gas for subsequent conversion to methanol, base chemicals and polymers. In fact, chemical recycling is upgrading low-quality waste plastics to thermoplastics of the highest quality as well as thermosets and non-polymeric chemicals.

I will present the concept of the cascade and the various constituting technologies, including yields and energy. I'll argue that such cascade of technologies allows to process most of collected plastic waste and displace up to 70% of the fossil feedstock with limited energy input, thereby achieving circularity that is comparable with that of metal, glass, and paper. It helps severely reducing the industry's reliance on fossil resources and its environmental impact created by spent product in/on soil, water and atmosphere.



Biography

Jean-Paul Lange is senior Principal Science Expert at Shell Technology and professor at the University of Twente, the Netherlands, where he is exploring novel catalytic processes for producing fuels and chemicals from biomass and plastic waste. He is co-author of 120 patents, 80 refereed papers, 10 book chapters and co-editor of 1 book

Scientific Abstracts

DAY 1

International Conference on

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Early stage recovery of lithium from lithium-ion batterie black mass in pilot scale

B Hansel[1], C Pätzold[1] and **M Bertau[1,2]**

[1]Technische Universität Bergakademie Freiberg, Institute of Chemical Technology, Freiberg, Germany
[2]Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Fraunhofer Technology Center for High-Performance Materials THM, Freiberg, Germany

Lithium-ion batteries (LIBs) have become an indispensable component of the electric mobility sector in recent years. However, existing industrial recycling processes (e.g. Umicore, Sony-Sumitomo, Toxco or Recuply process) are focused on the recovery of metals such as Co or Ni from the LIB black mass, rather than Li. As a result of the increasing demand and political competition for global Li deposits, a change in this trend is expected.

The COOL process a future-directed lithium recovery process in terms of circular resources chemistry, circular economy, and zero-waste concepts uses only supercritical CO_2 and water for LIB recycling. [1] This direct carbonisation bypasses the common problems of established hydrometallurgical processes, including high chemical consumption in the production of the Li trade forms Li_2CO_3 and $LiOH{\cdot}H_2O$ (leaching under acidic conditions and precipitation with e.g. Na_2CO_3 or NaOH). Due to the co-precipitation of Mn, Co and Ni in already established hydrometallurgical processes using NMC (Ni- Mn-Co oxides) LIBs commonly used in the electromobility sector, the separation of the products to obtain battery grade Li_2CO_3 is complex and expensive. The selective formation of $LiHCO_3$ in the COOL process removes Li at an early stage and simplifies this processing. Since $LiHCO_3$ has a sufficiently high solubility compared to Li_2CO_3, particularly high Li mobilisations are achieved. Due to the decomposition of the metastable LiHCO3 leaching solution, a Li_2CO_3-rich solution is obtained, which is enriched by electrodialysis.

Conclusions: The resource-efficient COOL process has been successfully applied at pilot plant scale (200 L autoclave) for the purpose of recycling LIB black masses. Using this pilot plant, Li yields of up to 97 % and Li_2CO_3 purities of 99.97 % have been obtained. According to the Li_2CO_3 purities, the battery quality required for reuse in LIB production was achieved.

Biography

B. Hansel is a student member of the Rectorate Commission on Education, Show Lecture of the Faculty of Chemistry and Physics of TU Bergakademie.

Climate change influence our built environment

Alan Tupicoff and **Siamndoyo**
Finding Other Solutions - Australia

Today, our cities are changing and encountering challenging times. Our environments, society and expectations have in recent years been tested and now create challenges for Project Managing both our new emerging city environments and managing our existing city environments. This presentation will deal with the integrated effects of our changing expectations, lifestyles and environments with a specific emphasis on "no one solution will address all the issues". This presentation will include discussion on the realization that there are many factors which influence the consideration of the "best solutions" and in fact the "real impact of climate change", both within our environment and our built environment, such as, almost 1/3 of the global population do not have access to technology, either due to inadequate infrastructure or a lack of user skills (or desire to use technology). As a result of such difference, technological solutions will need to consider changes in expectation and requirements, similar to those that are now being experienced throughout the built environment, including cultural, community, environmental, economic change. There are many such examples of these integrated impacts, and this presentation will explore a number of them, but also pose "questions for the audience to ponder and to open their need to probe for real answers and to engage in ongoing self-discovery and learning, as changes keep occurring. In this presentation is based on one basic fact, "Change will always occur it's just that the level and speed of change will be the main variable".

Biography

Alan Tupicoff from Australia and co-author (Sam) Siamndoyo from Indonesia have strong commitment to a sustainable future, with experience in all sectors, particularly within energy and construction. Alan had roles including former National Director AIPM - "Fellow AIPM" - President ANZISM - Executive Director (International), Finding Other Solutions, having lectured in universities and given Presentations at World Congress, Conferences and Summits across Australia, Indonesia, and Europe. Both Alan and Sam are part of the management team of Finding Other Solutions as well as Directors of ATSolve – consultancy / training. Published works include, a series of books relating to Sustainability Principles, to enhance awareness of the integration of sustainability into all aspects of life., MAPIS – a business and project assessment tool. Alan is also a member of IPMA SIG – "Smarter Urban Rural".

Production of renewable hydrogen from non-recyclable urban and industrial textile waste

Patricia Pérez Llamas[1], María Rodríguez-Rodríguez[1], Ivan Esteve-Adell[1], Marta García-Pellicer[1] and **Alfredo Quijano-López[1,2]**

[1]Instituto Tecnológico de la Energía (ITE), Avenida Juan de la Cierva, 24 46980 Paterna, Valencia, Spain
[2]Instituto de Tecnología Eléctrica, Universitat Politècnica de València. Camino de Vera, s/n 46022 Valencia, Spain

Given the increase in the textile waste generation due to the "fast-fashion" consumption model, the need to implement strategies for revaluing textile waste has become evident, thereby completing the circular economy cycle. This work proposes and additional valorization aproach with pyrolysis technologies for thermochemical transformation of non-recylable textile waste into a hydrogen-rich syngas to be used as an energetic carrier.

Textile wastes with highest potential for thermochemical valorization are identified. These are typically heterogeneous in composition and low bulk density. To facilitate processing and enhance process efficiency, densification through pelletization is performed.

The procedure is designed and optimized to develop the thermochemical reaction for the different textile waste streams, maximizing hydrogen production to be used as an energy carrier. Various compositions of cotton, polyester and their blends in different concentrations are evaluated to determine the technology's operational range. The energy efficiency obtained with different textile compositions is analyzed along with secondary products like biochar and bio-oil identifying their potential applications.

The syngas produced under various reaction condiciones (feedstock, temperature, flow rate, temperature gradients) is characterized to optimize the thermochemical process for hydrogen production from the selected textile wastes. This process adds value and promotes a circular economy in the textile production and consumption.

Biography

Patricia Pérez-Llamas is graduated in Chemistry from the University of Valencia in 2017. During the years 2018-2021 she worked at a biodiesel company contributing to improving production and developing new biodiesel production processes to enhance quality at lowerr costs. She join the Institute of Energy Technology (ITE) in April 2021 as a Researcher in the Recycling and Revalorization line, to work on various R&D projects developing sustainable materials from waste for diverse applications.

Waste pickers: A huge way for reusing and recycling waste with social, economical and environmental effect

Alessandro Stillo
IAWP International Alliance of Waste Pickers, Italy

Waste Picking is a unknown or misknown activity runned by 20 million people in the world, that give a big contribution to the reuse and recycle of waste. The waste pickers activities depends by the kind of garbage each country produce and, at the same time, it is conditioned by the laws that regulate waste collect. Contemporary life produces each year more waste, food, plastic, clothes that invade our cities and countries and that often western countries send to south world areas.

Waste picker is the general name that try to define a job with hundreds of definitions: recyclers, canners, dumpster divers, scrappers, reclaimers, biffin and chiffoniers, canners, cartoneros, raccoglitori.

For years waste pickers, the fruit of a system that accumulates, concentrates, excludes, destroys, and discards, have created their own forms of work in order to survive in a world that shows excessive aggression towards our environment, endangering all forms of life.

Now it is time to recognize the job and the role of waste pickers as workers, that give an important help to a sustainable world in a social, economical and environmental sense.

Biography

Alessandro Stillo, cultural manager, sociologist, expert of reuse and waste pickers. He has been part of ViviBalon, waste pickers Association of Turin, Italy, since foundation in 2001, and VicePresident and founder in 2011 of Rete ONU, National Network of reuse associations, cooperatives and companies.

He is actually President of Rete ONU, in the Board of ViviBalon and one of the referent of International Alliance of Waste Pickers in Europe.

He is working as consultant in Eco dalle Città (www.ecodallecitta.it) an Association that work on food recuperation and against food waste and for waste reduction, in Turin, Rome and Milan (Italy)

Green shields: The role of domestic gardens in enhancing air quality and thermal comfort

Karina Corada, Carolina Nash and **Stuart Connop**
Sustainability Research Institute, University of East London, UK

Domestic gardens are well-known for enhancing mental health and well-being, but their potential to improve air quality is underexplored. With escalating health risks from air pollution and climate change, it is more important than ever to investigate how domestic gardens can mitigate these issues. This pioneering study aims to understand the impact of various garden designs on local air quality and temperature regulation.

Eight domestic gardens in socially deprived areas with poor air quality were studied, including 1) Open non-vegetated garden, paved, 2) Open low-vegetated garden (grass) and 3) Vegetated barrier garden with a hedge. Field measurements were conducted continuously per week in each season from summer 2023 to spring 2024, measuring PM10, PM2.5, and temperature.

The findings reveal significant air quality improvements in gardens on heavily polluted streets, with reductions of 30% for PM10 and 40% for PM2.5, except in spring where the concentration increased probably due to weather conditions. In contrast, less polluted areas showed no notable improvements. Vegetated gardens demonstrated substantial PM10 and PM2.5 reductions of 76% and 80% in summer, and 42% and 30% in winter, compared to open, non-vegetated gardens. Additionally, hedges in front of vegetated gardens enhanced temperature regulation, slightly increasing temperatures in cold months by 0.58°C and reducing them in warm months by 2°C.

The study emphasises that the effectiveness of vegetated gardens in mitigating air pollution and regulating temperature depends on the location and season. Further research is needed to confirm these findings and assess the long-term performance of different garden designs in urban areas.

Biography

Karina Corada-Pérez is an interdisciplinary environmental chemist, currently working as a Research Fellow specialising in Air Quality and Green Infrastructure at the Sustainability Research Institute at the University of East London. Karina is highly skilled in solving the intricate issues surrounding urban environmental challenges, focusing on promoting green justice by enhancing air quality. Her research offers a comprehensive and up-to-date strategic view of implementing green infrastructure in cities to reduce exposure to air pollutants. She obtained a master's in Planning and Environmental Management and finished her PhD studies two years ago at the Centre for Environmental Policy at Imperial College London.

Mitigating the impacts of climate change by enhancing environmental sustainability and increased food security in rural Africa

George Ochuodho
Farm Africa, Kenya

Over the last two decades, the world has experienced significant climate and ecological changes.

Emissions of heat-trapping gases have already warmed the earth by nearly 2 degrees Fahrenheit (1.1 degrees Celsius) since 1850-1900. The global average temperature is expected to reach or exceed 1.5 degrees C (about 3 degrees F) within the next few decades . These changes are seriously affecting the entire globe leading to increased temperatures and heat waves, frequent storms, flooding, landslides, droughts, sand and dust storms and increased desertification among many other challenges that continue devastating millions of people. Africa, is emitting less than 10% of the greenhouse gases but is seriously bearing the brunt of Climate Change which has caused serious destruction of livelihoods through massive crop failures and death of livestock, increased poverty, hunger and starvation leading to death of many people. The suffering have been exacerbated by insecurity, rising inflation and debts and wars. At least one in five Africans goes to bed hungry and an estimated 140 million people in Africa face acute food insecurity. In Kenya the Government declared the drought affecting parts of the country a national disaster in September 2021. Increased food insecurity caused by widespread livestock deaths, minimal livestock productivity, very low crop yields, and sharp declines in purchasing power are creating large food consumption gaps and high levels of acute malnutrition among millions of households in eastern and northern Kenya. According to Famine Early Warning Systems Network (FEWS NET May 2022 Report) a total of 4-5 million people were in need of humanitarian food assistance in Kenya, with a higher number falling into severity of acute food insecurity, Emergency (IPC Phase 4). The drought extended to 2023 and the country received very minimal rainfall during the March to May 2023 which in the past were long rainy season, this marked the fifth consecutive below average season and was historic in its length and severity this led to a severe drought and insufficient access to food and water, increased resource-based conflicts and communal violence, limiting agricultural outputs and livelihood opportunities while also reducing populations' ability to cope with future shocks. In March to May 2024, the country experienced long rains and El Niño weather patterns this led to increased flooding with at least 150,000 people displaced as of late April; flood-displaced populations who were in need of emergency relief commodities and food, shelter, and water, sanitation, and hygiene (WASH) assistance, according to the UN and the Government of Kenya. The country is back to the mode of extended periods of drought and forecast models are now signaling worsening drought and this will only increase the severity and scale of food assistance need into succeeding years and a significant and sustained scale up of humanitarian assistance to save lives and livelihoods. Other challenges that worsen the situation include; environmental degradation, low production and productivity of crops and animals, lack of adoption of climate smart agricultural technologies, poor agricultural credit access, poor access to quality agricultural inputs and seed varieties as well as emerging crop/ livestock diseases that farmers are ill prepared to handle. Climate change

is challenging youth employment and overall economic growth and poses health risks, food insecurity, violence, displacements, and disruption of education systems and loss of lives for Children. The situation is aggravated by poor adaptive capacity to deal with climate change both at the national and county levels. Women and children are usually the worst affected by this lack of adaptive capacity as they make the largest proportion of those engaged in climate dependent livelihood sources. The situation has resulted into increased vulnerability of most households due to destruction of their livelihoods and destabilization of their resilience.

Climate and environmental hazards, shocks and stresses are already having devastating impacts on the well-being of families and mainly children globally. As these boundaries are breached, so too is the delicate natural balance that human civilization has depended upon to grow and thrive. And as a result, the climate crisis is creating human rights crisis including food, water, health and education crisis and threatening people's survival especially women and children. In all these ways, it is infringing on children's rights – as outlined in the United Nations Convention on the Rights of the Child. Understanding where and how children are uniquely vulnerable to this crisis is crucial in responding to it.

Biography

I am a well-rounded professional with Master of Business Administration (Finance) Bachelor of Science (Agriculture) both from University of Nairobi and a Post-Graduate Diploma in Education (Biolog and Agriculture) from Maseno University-Kenya. I also have over 20 years of experience in sustainable Agriculture and Climate Change mitigation and Adaptive Strategies, I have technical skills, creative solutions to problem solving, networking, value addition, local and export market linkages, working with gender and youth, alliances building and partnerships with both public, private and other Development Organizations to achieve maximum impacts through enhanced food productivity and production, improved incomes and building the resilience of households.

Succession and reconstruction of soil microbial communities following fumigation

Wensheng Fang and **Qiuxia Wang**
Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Soil fumigants, recognized for their strong diffusion in soil and broad-spectrum inhibition of pathogens, have become an effective method for controlling soil-borne diseases before planting. However, the processes governing the succession and regulation of microbial communities after fumigation remain largely unclear. Our research indicates that the effects of fumigation on microbial diversity vary depending on the type of fumigant used, are influenced by the dosage applied, and tend to diminish over time. Notably, both positive and negative changes in the structure of microbial communities have been observed. Fumigation also alters soil ecological functions, accelerating the conversion and metabolism of key nutrients such as nitrogen and potassium. Among pathogens, Fusarium showed greater resilience to fumigation compared to Ralstonia solanacearum. Interestingly, bacterial community assembly is largely driven by deterministic processes, whereas the assembly of fungal communities appears to follow a more random, stochastic pattern. Soil nutrients, particularly those added through fertilization, are crucial for the rapid recovery of bacterial and fungal populations after fumigation. In fact, there is a significant positive correlation between the rate of microbial recovery and the amount of fertilizer applied. Based on these findings, we developed a comprehensive soil-borne disease control strategy that integrates soil disinfection with microbial community activation. This strategy has already been successfully implemented in crops such as ginger and Panax notoginseng, proving its effectiveness in enhancing crop health and productivity.

Keywords: Soil fumigation, Soil microorganism, soil-borne diseases and Microbial succession

Biography

Dr. Fang Wensheng, born in July 1989, is an Associate Researcher at the Chinese Academy of Agricultural Sciences and a key member of the Soil Pest Control Innovation Team. His research focuses on soil fumigation technologies and mechanisms for controlling soil-borne diseases, and their effects on nutrient cycling and microbial communities. He has led and contributed to numerous national projects and published 54 scientific papers, including 16 in top-tier journals like Journal of Hazardous Materials. His work has been applied to over 300,000 acres of crops annually, earning him multiple awards.

Microbial regulation in biofumigation: Reducing soil-borne pest risks to boost cowpea yield

Yutong Ji
State Key Laboratory for Biology of Plant Disease and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Biofumigation with Brassica plants has emerged as a sustainable and eco-friendly strategy for managing soil-borne pests, demonstrating substantial potential for advancement and application. Soil-borne pests are a critical factor affecting crop yields. Furthermore, soil physicochemical properties, enzyme activity, and microbial community composition play integral roles in soil health and, consequently, in crop productivity. Despite this, the interplay among these soil indicators and their collective impact on cowpea growth following biofumigation remains poorly understood. This study examined the effects of biofumigation with cabbage (Brassica capitata) and cauliflower (B. botrytis) residues, both individually and in conjunction with nematicides, on a range of soil and plant parameters. The results indicated that biofumigation significantly increased the inhibition rates of soil-borne pests, ranging from 52.89% to 92.70%. Additionally, soil physicochemical properties and enzyme activity were enhanced by 0.41% to 119.12%. The relative abundance of beneficial microorganisms, including Firmicutes, Bacteroidota, and Ascomycota, was elevated by 13.40% to 60.19%. Furthermore, cowpea yield was substantially increased by 21.70% to 77.83%. Comparing the standard B. capitata treatment with 1.3 times the amount of B. capitata treatment revealed that the higher dosage did not enhance pest inhibition rates but significantly improved cowpea yield, suggesting the involvement of alternative mechanisms. To elucidate these mechanisms, a structural equation model was developed based on correlation analysis. The model indicated that Firmicutes and Bacteroidota indirectly influence cowpea yield through their effects on soil ammonium nitrogen, organic matter content, and catalase activity, with soil ammonium nitrogen emerging as the most significant direct factor (0.74***). These results highlight the substantial potential of biofumigation with cabbage and cauliflower residues for enhancing soil ecological health, and promoting sustainable agricultural practices.

Biography

The presenting author of this abstract is a doctoral student at the Institute of Plant Protection, Chinese Academy of Agricultural Sciences. She is in her third year in the Department of Pesticide Science, specializing in pesticide biology. Her research interests focus on exploring the effects of environmentally friendly, cost-effective, and sustainable biofumigation using Brassica plants on soil-borne pathogens, root-knot nematodes and various soil health indicators. Additionally, she investigates changes in soil microbial communities and subsequent crop growth, aiming to clarify the application potential of biofumigation. This research contributes to reducing chemical inputs and provides insights for identifying alternatives to chemical fumigants.

Fumigation enhances soil manganese availability by altering the structure of the manganese-oxidizing microbial community

Xin Wang, Dong dong Yan and **Qiuxia Wang**
State Key Laboratory for Biology of Plant Diseases and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Manganese is one of the essential trace elements for plants to maintain normal life activities. Soil fumigation, while effectively controlling soil-borne diseases, can also improve the cycling of soil nutrient elements. This experiment focused on the microbial mechanisms responsible for the increase in available manganese in the soil after fumigation. MiSeq amplicon sequencing is used to determine the composition of soil microbial communities, and structural equation modeling and the random forest algorithm are employed to conduct a correlation analysis between key manganese-oxidizing microorganisms and soil manganese availability. The experiment found that Bacillus, GeoBacillus, GraciliBacillus, Chungangia, and Pseudoxanthomonas are key species influencing the variation in soil available manganese content. Fumigation was observed to increase the abundance of Bacillus. Additionally, laccase activity was identified as another key factor affecting soil manganese availability, with its activity being indirectly correlated with available manganese content and contributing to 58% of the observed variation in available manganese content. In summary, alterations in manganese-oxidizing microorganism communities following soil fumigation are pivotal for enhancing soil manganese availability.

Biography

The author of this paper is Wang Xin, PhD, Institute of Plant Protection, Chinese Academy of Agricultural Sciences. His main research topic is the change of trace element manganese after soil fumigation and its microbiological mechanism.

Synergistic effect of anaerobic bacteria NJYB-1 on soil anaerobic disinfection

Hongyu Wang
State Key Laboratory for Biology of Plant Disease and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Problem Statement: Anaerobic soil disinfestation (ASD), as a bio-fumigation technology, has been developed to control soil-borne pests. ASD is facing difficulties in dissemination due to long disinfection time, high cost and unstable effectiveness.

Methods: This study evaluated the effectiveness of key functional microbial screening after ASD and the combination of key strains with ASD for the control of soil-borne diseases.

Results : The results showed that the anaerobic bacterium NJYB-1 was screened out from the soil after ASD treatment, and the indoor bioactivity assay showed that the bacterial strain had more than 50% inhibitory activity against soil-borne pathogenic fungi such as Fusarium spinosum and Fusarium rickettsiae, and the ASD technology of adding the bacterial strain reduced the dosage of the carbon source by 50%, which greatly reduced the cost of its use, and the field experiment showed that the ASD and the ASD+bacteria treatments significantly promoted the growth of the tomato plants, especially the ASD+B treatment increased the tomato plant height and stem thickness by 44 26% and 24 02%, respectively. The field test showed that ASD and ASD + bacteria treatment can significantly promote the growth of tomato plants, especially after ASD + B treatment, tomato plant height and stem thickness increased by 44.26% and 24.02% respectively; compared with the blank treatment yield, ASD + bacteria treatment can significantly increase tomato yield by 34.12%.

Conclusion: Field experiments showed that the addition of strain NJYB-1 to the ASD treatment rapidly initiated the disinfection process, and the ASD technology after the addition of strain NJYB-1 showed high bioactivity for soil-borne pathogens, and significantly promoted the growth of tomato plants after the treatment, especially after the addition of strain NJYB-1, which had a significant effect on the increase in tomato plant height and stem thickness, and also significantly increased the yield of tomato, indicating that strain NJYB-1 plays a key role in the ASD disinfection process. 1 plays a key role in the ASD disinfection process.

Biography

Hongyu Wang, PhD, Institute of Plant Protection, Chinese Academy of Agricultural Sciences.

Impacts of climate change on crop water requirement in the semiarid region: A case study of bilate watershed, Ethiopia

Yoseph Arba Orke
Arba Minch Water Technology Institute, Ethiopia

The aim of this study was to investigate the potential effects of climate change on the Bilate watershed's crop water requirements (CWR). Under two climate scenarios (RCP4.5 and RCP8.5), the CWR was projected for the time periods 20212050 and 20712100. The power transformation and variance scaling approaches were employed to correct the bias in the climate parameters of rainfall and temperature. For the baseline and future periods, the CROPWAT 8.0 model was used to simulate CWR and crop irrigation requirements (CIR). In 20712100, projected results show a 36.6% to 38.7% decrease in effective rainfall (Pe), with an increase in crop water requirements of up to 16.3 mm to 36.1 mm under the RCP8.5 scenario per growing season, but different crops have different decreasing/increasing rates. In a similar way, by comparison with the baseline period, the anticipated irrigation requirements increased for wheat (68.1 mm to 81.6 mm), tomato (163 mm to 193 mm), sorghum (80 mm to 102 mm), maize (121 mm to 134 mm), cotton (163 mm to 192 mm), and cabbage (193 mm to 221 mm). The findings of this study are useful in describing how crop water supply in the Bilate watershed is negatively impacted by climate change, and they also help with better planning for the management of water resources.

Biography

Yoseph Arba Orke earned his PhD in June 2022 from National Central University and Academia Sinica, Taiwan College of Earth System Sciences. He coordinates PhD programs at Arba Minch University's Faculty of Meteorology and Hydrology. He has published papers in reputable journals and served on the committee that established the Climate and Atmospheric Research Center.

Rethinking plastics: Circular strategies for a greener future

Roger Achkar
Global Waste Cleaning Network, UK

Introducing GWCN – Global Waste Cleaning Network

The Global Waste Cleaning Network (GWCN) is an international non-profit environmental organization, composed of:

- Non-governmental organizations
- Educational and research institutions
- Private and public sector companies

GWCN's members work across 187 countries, focusing on managing and reducing various types of waste:

- Solid waste
- Liquid waste
- Gaseous waste

Circular Economy and Plastic Waste Management

The presentation highlights several key points:

1. Global Plastic Waste Problem: The mismanagement of plastic waste and its global impact, including plastic in oceans.

2. Waste Composition and Disposal by Income Levels: Based on data from the World Bank, the presentation outlines waste management disparities between regions with different income levels.

3. Circular Economy Approach: Emphasis is placed on transitioning to a circular economy through:

o Eliminating environmental waste

o Efficient use of plastics

o Maximizing resource recovery from plastic waste

Special Cases: Bioplastics and Black Plastics

Special considerations for certain plastics like bioplastics and black plastics are discussed, as they pose unique challenges in recycling.

Role of Governments

The presentation stresses the importance of government action to:

- Raise awareness about the use of recycled plastics

- Invest in recycling infrastructure, especially in developing nations
- Impose better labeling for recyclable products
- Penalize products difficult to recycle
- Provide incentives for consumers to minimize plastic use

Conclusion

The presentation concludes with notes on the importance of creating sustainable solutions for plastic waste through a joint effort of governments, businesses, and consumers.

Biography

Dr. Roger Achkar presentation focuses on creating a circular economy through recyclable and reusable plastic products and highlights strategies to manage plastic waste more effectively, including raising consumer awareness, improving infrastructure, and encouraging governments to promote sustainable practices. Dr. Achkar's expertise contributes to a broader initiative driven by the Global Waste Cleaning Network (GWCN), an international non-profit environmental organization dedicated to waste management and reduction

Trend analysis of the hansen three-variable climate graph as a predictiveroadmap based on paleoclimatology

Thomas F Valone
Integrity Research Institute, USA

For the first time in history, global population has tripled in less than one lifetime, annual carbon dioxide emissions have quadrupled, and global energy consumption has quintupled, all in the same period, thus multiplying the environmental stress tremendously. In 2006, climatologist James Hansen discovered and published a remarkably linear relationship between CO_2, temperature, and sea level rise, based primarily on the Vostok ice core data for the past 400,000 years. Since then, scrutiny and analysis of the best climatologists' models have confirmed that Hansen's simple equation can be applied today. The half-million-year, maximum world carbon dioxide concentration of 290 ppm for the entire epoch has been widely overlooked. The consequence has provoked a widespread misdirection of priorities for solving climate change in the shortest amount of time. Not only did Hansen accurately predict the present temperature increase thirty years in advance but his model can be extrapolated toward future decades in remarkable agreement with current models. Hansen's equation yields an expected temperature increase 6°C by 2100 which has been called "irreversible" by NOAA. Global warming, driven by the potent, heat-trapping atmospheric CO_2 level whose rate, as well as level, continues to increase exponentially. The earth is currently in the midst of dramatic glacial melting, human migration, widespread heat maxima, and mega-droughts. The 10 warmest years in the 174-year record have all occurred during the last decade (2014–2023). Included are technical projections of climate change according to the Hansen Climate Graph, along with recommended solutions for reversing it and restoring environmental sustainability.

Biography

Thomas Valone has a PhD in General Engineering and a Masters in Physics. He is the President of Integrity Research Institute. He has published more than 100 papers in peer-reviewed journals and periodicals, as well as written or edited over a dozen books, including The Future of Energy: *Challenges, Perspectives, and Solutions,* by Nova Science Publishers in 2020. He is a former instructor at Erie Community College, a retired US Patent Primary Examiner, and a licensed Professional Engineer (NYS 62475).

Global disparities in renewable energy implementation are obstacles to climate change mitigation

Nematullah Wafa
RenewSphere, France

Yet the disparity in using renewable energy is one of the largest challenges to global action on climate change and achieving net-zero emissions by 2050. This paper studies the economic, technical, and human skill shortages that lead to these disparities. The paper examines the current trend of investments, geopolitical impacts, and financial burdens on renewable energy, and presents an analysis of some current barriers to low-income countries. To close these gaps, it is proposed that increased commitment at all levels of society, as well as integrated methods supported by technology innovation and international cooperation, will help in the development of solutions such as enhanced policy frameworks. The study explains why we should focus globally on deploying renewables as quickly as possible climate change causes irreversible damage.

Biography

Nematullah Wafa has completed his second master degree at the age of 28 years old from IMT Atlantique Engineering School in France. He is the founder and director of RenewSphere, a renewable energy and sustainability organization based in France. He has published and contributed to more than 10 reports and papers in international journals and organizations. He has served renewable energy and sustainability sectors for more than 6 years.

Analysis of the key factors that influence the efficacy of metam sodium against soil-borne pests

Xinhua Chen
State Key Laboratory for Biology of Plant Disease and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Metam sodium (MS) use increased when the ozone-depleting fumigant methyl bromide was banned for soil fumigation. When MS is applied to the soil, it generates the pesticidal gas methyl isothiocyanate (MITC). Our research aimed to assess the relationship between the degradation half-life of MITC, the area under the concentration-time curve (MITC-AUC) of MITC in solid-liquid-gas phases under different conditions, and the effectiveness of controlling soil-borne pathogens in soils from different regions in China. The MITC concentration peaked about 1.5-1.75 h after MS was applied to the soil and then subsequently decreased. MITC-AUC varied according to soil type. We observed that, except for the soil from Sichuan, the highest MITC concentration occurs at a soil water content of 15%. Increase in soil temperature accelerated the degradation rate of MITC and reduced the size of MITC-AUC, while high concentrations of MS increased MITC-AUC. The degradation rate of MITC decreased when the soil was amended with 2% organic matter or less. The MITC-AUC and degradation half-life values were positively correlated with efficacy against Fusarium spp. and Phytophthora spp., and negatively correlated with available potassium and phosphorus present in the soil. Mortality of both species exceeded 90% when MITC-AUC exceeded 1,900 mg kg-1 h. Soil type, soil water content, soil temperature, MS dosage and soil organic matter content affect the quantity of MITC produced and degradation. Our study found that among the soils from 10 regions in China, the MITC-AUC was highest in the soil from Zhejiang. In four typical soils, the MITC-AUC showed different trends with increasing moisture content, indicating the need to adjust the dosage of metam sodium according to local conditions. As the temperature increases, the MITC-AUC decreases in all four soils, indicating that MS should not be used at excessively high temperatures. Additionally, doubling the dosage of metam sodium did not result in a proportional increase in MITC-AUC in all typical soils. Therefore, it is not scientifically sound to rely solely on increasing the MS dosage to improve control efficiency in different soils.

Biography

The speaker is a PhD candidate at the Institute of Plant Protection, Chinese Academy of Agricultural Sciences, and will be enrolled in the PhD program in 2023. The master's degree is a joint training student of the Institute of Plant Protection, Chinese Academy of Agricultural Sciences and Jilin Agricultural University. During the master's degree, the research content mainly includes the degradation of Metam Sodium, its relationship with microorganisms, and field application.

Microecological mechanism behind the alleviation of common bean root rot disease after 7-year continuous cropping

Rongjun Guo[1], Li Yang[1,2], Adegboyega Adeniji[1], Gantsetseg Ganbaatar[1], Xiaohong Lu[1], Shidong Li[1] and **Boming Wu[2]**

[1]State Key Laboratory for Biology of Plant Diseases and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing 100193, China
[2]Department of Plant Pathology, China Agricultural University, China

Root rot is an important disease in common bean production, especially in the continuous cropping field with large input amounts of chemical fertilizers. However, it is less known about the relationship between the root rot severity under continuous cropping pattern and the balanced application of chemical fertilizers as well as the shift of rhizosphere microbial communities.

In this study, the common bean was monocultured for eight cycles between 2018 and 2021 at an average interval of 4 months. The disease severity of root rot was investigated at each cropping cycle, and the bacterial and fungal communities of the bean rhizosphere soils of the 1st, 5th, and 7th cropping cycles were analyzed by using the high-throughput sequencing approach. The disease severity of the common bean root rot was found to keep increasing until the 5th cycle and then plunged at the 7th cycle. Corresponding to the disease aggravation and suppression, Fusarium exhibited the highest abundance at the 1st cropping cycle, followed by *Plectosphaerella* at the 5th cycle and *Dactylonectria* at the 7th cycle, and Pseudomonas showed the highest abundance in the rhizosphere soils at the 1st and 7th cropping cycles. Correlation analysis indicated that the soil microbes mentioned above were closely related with disease severity as well as soil nitrogen/phosphorus contents.

These results suggested continuous cropping of common bean with fertilizer supplementation could form suppressive soil and reduce the disease severity correspondingly. This study sheds light on the micro-ecological immune mechanism of continuous cropping of common bean against root rot and offers practical technique for sustainable agricultural practices.

Keywords: Continuous Cropping, Rhizosphere Soil, Chemical Fertilizer, Common Bean Root Rot and Soil Microorganism.

Biography

Rongjun Guo is an associate professor, plant pathologist and soil scientist at the Biological Control Innovative Research Center, Institute of Plant Protection, Chinese Academy of Agricultural Sciences. Her main activities revolve around teaching and supervising graduate students and conducting research in the research center. Her research interests relate to the screening and identification of beneficial microorganisms, interactions of the microorganisms with plants, soil and phytopathogens, the development of biocontrol agents and their application techniques.

Root-knot nematode infection promotes soil nutrient P transformation and Cd dynamics in yam cultivation

Sa Xiao and **Wensheng Fang**
State Key Laboratory for Biology of Plant Disease and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Root-knot nematodes significantly constrain yam production, yet their impact on soil nutrient conversion and absorption is not well understood. This study used mass spectrometry and metagenomic sequencing to compare nutrient element and heavy metal transformations in yam soils with severe nematode infestation to those in healthy soils. The findings revealed that nematode-infected soils experienced significant disruptions in the conversion of essential growth elements (N, K, Fe, Mn) and heavy metals (Hg, Pb, Cr, As, Cu, Ni). Notably, P and Cd levels were lower in infected soils but showed marked accumulation in diseased yams. This was driven by a significant increase in specific microbial populations and genetic pathways. Infected soils were enriched with microorganisms involved in phosphorus transformation, such as Phyllobacteriaceae, Rhodanobacteraceae, Rhizobiaceae, and Chromobacteriaceae, and genes related to phosphate mineralization (phn) and phosphorus transport (ugp) were upregulated. For cadmium metabolism, microorganisms including Hyphomicrobiaceae and Bradyrhizobiaceae, along with cadmium metabolism-related genes (czcA, czcB, zntA), increased substantially. Root-knot nematodes primarily affect phosphorus-converting microorganisms indirectly through changes in soil properties, whereas nematode infestation directly and indirectly impacts Cd-metabolizing microorganisms by altering soil characteristics significantly. These results provides insights for developing strategies to mitigate the adverse effects of root-knot nematodes on yam production.

Biography

The speaker is a joint training student of the Institute of Plant Protection, Chinese Academy of Agricultural Sciences, and Nankai University, with a research focus on pesticide science. During the master's program, the research mainly includes the study of the disease mechanism of yam root knot nematodes, and participation in the biological research of cyclic dinucleotides.

Effects of chloropicrin fumigation combined with biochar on soil bacterial and fungal communities

Yuan Li, Jiahong Zhu, Wensheng Fang, Dongdong Yan, Qiuxia Wang and **Aocheng Cao**

Institute of Plant Protection, Chinese Academy of Agricultural Sciences, China

Chloropicrin (CP) can cause long-term damage to beneficial microbes which reduces soil health. Biochar (BC) can mitigate against the effects of CP by reducing the time for beneficial microbes to recover after CP fumigation.

In this study, we used Real-Time Quantitative PCR to determine the effects of different rates of BC added to CP-fumigated soil on the speed of recovery of bacteria and fungi population and on changes to gene copy number of the target pathogen *Fusarium oxysporum*. We compared the structure and composition of the beneficial microbial community in the different treatments soil by using High throughput Illumina sequencing.

As the results shown, adding 1 or 3% BC after CP fumigation accelerated the recovery of bacterial and fungal populations without increasing *F. oxysporum* abundance. BC also promoted the recovery of beneficial bacteria *Rokubacteria* and *Latescibacteria* damaged by CP. And these two bacteria may be related to the immunity of soil to *F. oxysporum*. In CP-fumigated soil, BC improved the disease resistance of the soil by increasing beneficial microbes, such as *Steroidobacter, Sphingomonas, Purpureocillium* and *Mortierella*. This combination of CP and BC is a new concept that could encourages the development of a healthy and sustainable soil ecosystems while controlling plant pathogens.

Keywords: Real-time quantitative PCR, Illumina high-throughput sequencing, microbial community structure, Rokubacteria, Latescibacteria.

Biography

Yuan Li, Ph D Now she works as Associate Professor at the Institute of Plant Protection, Chinese Academy of Agricultural Sciences. She served as the Deputy Secretary General of the Soil Disinfection Branch of the China Agricultural Ecological Environment Protection Association, a member of the China Plant Protection Society, and a member of the Beijing Pesticide Society. Mainly engaged in the detection and identification of soil borne pathogens, soil disinfestation and control of soil borne diseases, and research on the mechanism of action of fumigants on soil borne pathogens and microbial communities. At present, she has presided over 5 projects including the National Natural Science Foundation of China and the central government guides local science and technology development funds. She has published more than 50 SCI papers published in international SCI journals such as *Pest Management Science, Plant Disease, Science of the Total Environment, Environmental Pollution, Journal of Agricultural* and *Food Chemistry*, and serves as a member of Editorial Board in *Agriculture*.

Waste management and the circular economy in Mexico

Lorena De Medina Salas
Universidad Veracruzana, Faculty of Chemical Sciences, Mexico

Mexico has been developing little steps to build a circular economy through the valorization in the waste management system. In Mexico, 24 States have been using a differentiated collection, however, only approximately 7 % of municipal solid waste (MSW) are treated, especially the organic fraction through the composting and anaerobic digestion processes. Meanwhile, the inorganic fraction is rarely valorized (9.6 % of the national total of MSW). In fact, there are only 25 separation plants of MSW across the country. The federal and local government are modifying the environmental public policies aimed to promote the recovery of all waste fractions, through the establishment of waste management programs that involve the prevention of the generation of MSW with citizen participation and separation from the source. Since the year 2019, through government initiatives, the use of single-time plastics was banned, thus contributing to generate sustainable development. The government has also encouraged the establishment of collection centers for the different usable fractions of the MSW, generating new value chains through the sale of by-products that contribute to the local circular economy. The general population has been positively receptive to the implementation of these programs and many local governments have implemented fiscal mechanisms to encourage citizen participation. The industrial sector has also committed to the establishment of these environmental policies, and they are participating in the value chains for the reuse and reprocessing of the different recoverable waste. In this way, Mexico takes the forefront in Latin America in the prevention and valorization of MSW.

Biography

Lorena De Medina Salas completed her PhD at age 29 at Pacific Western University, USA. She is a full-time professor and researcher at the Faculty of Chemical Sciences, Universidad Veracruzana in Mexico, with 18 years of experience. She has published more than 70 papers and has been serving as a scientific reviewer for reputed journals. She belongs to the National System of Researchers in Mexico.

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2nd International Conference on

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NOVEMBER 21-22, 2025 | ROME ITALY

Accepted Abstracts

DAY 1

International Conference on

Recycling and Earth Science

OCTOBER 21-22, 2024 | ROME, ITALY

Solving the damage caused to ecosystems and water courses by roadside litter

Ben Scott-Robinson
CEO of Roadbot, Gosport, UK

The roads of Europe are drowning in waste. A study in the UK showed that more than 1.3 tonnes of non-biodegradable materials were either dumped or discarded from cars for every 1km of major road every year.

The cost of disposing of this litter approaches €7000/km. In the green verges, litter can only be collected by hand using a litter picker at one piece per 4 seconds on average, and can only be done when the nearside carriageway is closed. Deploying these teams can often only be done at night, and require the deployment of traffic cones and signage to provide safety for the litter picking crews.

Litter, despite being the single largest complaint by the public to the UK's National Highways, is not viewed as a strategic priority. For this reason, litter is often left to build up. In the best case, it is cleared twice a year. In the worst case, every five years.

And the damage is more than being an eyesore. In the UK, over 3 million animals are believed to be killed by the ingestion of roadside litter. Plastic pollution, often ground up by strimming and grass cutting activities, leaches into the surrounding water courses and poisons the soils. Disposable vapes, old batteries and other electronic devices also contain heavy metals that pollute for generations. Remains of tyres and parts of cars left over from accidents and breakdowns create an active risk to drivers.

This is a problem that can be solved by the application of robotics and AI. Autonomous vehicles, deployed to vacuum or pick up litter, could resolve this problem. The same vehicles can also record pollution and biodiversity in the green verges - a largely untouched area that could be a haven for wild plants, insects, birds and mammals if properly managed and monitored.

Also, removing the process of manual litter clearance would save over 2 tonnes of CO2 emissions per km per year.

This solution offers an opportunity to convert the 'wasteland' next to major roads into a biodiversity haven - over an area of more than 200,000 hectares across Europe - double the size of the Pyrenees and Black Forest National Parks put together.

Near real-time material composition analysis for enhanced pcb recycling

Aleksander Jandric[1], Christian Zafiu[1], Gerrit Hermann[2] and **Stefan Salhofer[1]**

[1]*Institute of Waste Management and Circularity, University of Natural Resources and Life Sciences, Vienna*
+Institute of Analytical Chemistry, University of Natural Resources and Life Sciences, Vienna

Printed circuit boards (PCBs) are among the most valuable components in electronic waste, yet only 34% are recycled sustainably. Improving this rate requires faster, more reliable material analysis methods. This presentation introduces a new approach to near real-time analysis using X-ray fluorescence (pXRF) technology, enhanced with a newly developed post-hoc calibration methodology for enhanced accuracy.

The method has shown a significant improvement in analyzing key metals like Cu, Pb, Ni, and Au with an average inaccuracy of just 5% compared to the Certified Reference Material (CRM). By enabling near real-time insights into material composition, this approach accelerates decision-making in recycling processes and reduces environmental impacts. Its adaptability makes it suitable for analyzing a variety of electronic waste, including batteries and contaminated soils, offering a promising tool for improving global e-waste management.

High-quality recycled polymers: New technologies, applications and success stories

Angel Martinez-Leon
Polytechnic University of Madrid, Spain

This is about giving a brief overview of the latest technologies applied in the recycling of polyolefins and styrenes through successful cases already implemented in the market. Technologies such as the separation of polyolefins by flotation in water only, the separation of crushed polymers by optics, even black ones, decontamination, deodorization and delamination by water vapor and its final decontamination by sc-CO2 in an extruder generate a set of technologies capable of obtaining high quality recycled polymers applicable in the most demanding packaging applications such as those that comply with ADR (*Agreement concerning the International Carriage of Dangerous Goods by Road*) legislation and food contact.

Impacts of lulc and climate changes on hydropower generation and development: A systematic review

Emmanuel Kekle Ahialey, Amos T. Kabo–Bah and **Samuel Gyamfi**
University of Energy and Natural Resources (UENR), Ghana

There is a growing concern on a global scale that the world should transition towards the utilisation of energy-efficient technologies. Hydropower plays a very significant part in the fight against climate change, and as a result, it lessens the impact that climate change will have on our ability to achieve the Sustainable Development Goals (SDGs). Both the effectiveness of hydropower generation and the amount of streamflow are impacted by climate change as well as land use and land cover (LULC). Accordingly, the purpose of this study is to conduct a literature review on the topic of the past and future effects of climate, land use, and land cover changes on hydropower generation. A systematic literature review was carried out to analyse how LULC and climate change will affect hydropower generation and development based on 158 pieces of relevant literature that had been reviewed by experts and indexed in Scopus, Google Scholar, and Science Direct. The review was carried out to determine three goals: the impact of climate change on hydropower generation and development; the impact of climate change on streamflow; and the combined impact of changes in climate and changes in LULC on hydropower. The findings bring to light the primary factors contributing to climate change as well as shifts in LULC which are essential to the generation of hydropower on all scales. The study identifies factors such as precipitation, temperature, floods, and droughts as examples of climate change. Deforestation, afforestation, and urbanization are identified as the primary causes of changes in LULC over the past several decades. These changes have a negative impact on the generation and development of hydropower.

Levels and health risk assessment of chlorinated organophosphate esters in indoor and outdoor dust

Layla Salih Al-Omran and **Banan Baqer Hashim**
Department of Chemistry, College of Science, University of Basrah, Iraq

The main three compounds of Cl-OPEs are tris(2-chloroethyl) phosphate (TCEP), tris(2-chloroisopropyl) phosphate (TCIPP), and tris(1,3-dichloroisopropyl) phosphate (TDCIPP). As flame retardants, they are commonly employed in building materials, electronics, and vehicle parts, to enhance their ignition resistance. As additive chemicals, Cl-OPEs can be transferred from treated products into the environment. The toxicity of Cl-OPEs has led to concern about human exposure. Dust ingestion has been identified as a major exposure route. The study is designed to evaluate the levels of Cl-OPEs in indoor and outdoor dust from Basrah, Iraq, and to estimate the daily intake (EDIs) via dust ingestion. Dust samples were collected from homes (20), the front yard of the house (20), cars (24), and roads (23). The concentrations of ∑3Cl-OPEs in cars ranged from 4119 to 73232 ng/g (median 11662 ng/g), with TDCIPP as the predominant compound, while in homes they ranged from 780 to 15140 ng/g (median 3942 ng/g), with TCIPP as the predominate compound. ∑3Cl-OPEs in front yards ranged from 312 to 5481 ng/g (median 1027 ng/g), while in road dust, they ranged from 269 to 3395 ng/g (median 373 ng/g), with TCIPP as the predominant compound. As semi-volatile organic compounds, Cl-OPEs that are emitted from the interior of a vehicle have the potential to be concentrated due to the limited space. In addition, due to its high cost, TDCIPP is only employed in applications needing an extremely high degree of flame retardancy, such as textiles in vehicle seating. This may explain the high levels of TDCIPP in car dust compared with other Cl-OPEs. The EDIs via dust ingestion for the Iraqi population were well below the reference dose values. However, for people who spend a large amount of time in their vehicles, such as taxi drivers, EDIs were seven times higher than those of regular adults.

Transforming waste into value: Sustainable production of platform chemicals in Sweden

Sima Ajdari and **Amir Soleimani Salim**
RISE Research Institutes of Sweden, Sweden

The need for biogenic-carbon atoms is increasing as the industry attempts to comply with emission reduction goals while meeting the increasing demand for carbon-based materials such as plastics. Meanwhile, the amount of biogenic feedstock available to produce biogenic-carbon atoms is limited. In Sweden, approximately 7Mton/year of municipal solid waste (MSW) is created and roughly 60% of the carbon in the Swedish MSW is biogenic. Currently, the MSW that can't be recycled in Sweden is incinerated for energy recovery and the CO2 in the flue gas is emitted to the atmosphere. The waste management companies are considering decreasing the climate impact of their energy recovery units by adding carbon capture and storage (CCS) downstream of the incineration units. Although the capturing and storing biogenic carbon in MSW can lead to negative CO2 emissions, there might be more viable alternatives to the biogenic carbon of MSW into more valuable carbon-based chemicals to phase out the fossil fuels.

This project assesses utilizing the MSW streams to produce platform chemicals, thereby making use of the biogenic carbon in the MSW. In this project, a holistic approach is used to evaluate if using the carbon in MSW to produce circular chemicals might be a better option by assessing the climate-, cost- and policy perspective of producing platform chemicals from MSW fractions via gasification or energy recovery coupled with carbon capture and utilization (CCU).

Initially, scenarios for the future composition of MSW have been developed, fed to advanced process models (Aspen plus) for the CCU- and gasification value chains to calculate mass and energy balances. Capital cost and cost of production has been calculated based on the calculated balances and sizing of the major equipment. Life cycle analysis is used thereafter to evaluate the environmental performance, resource use, and value chain cost. Finally, the effect of policy instruments, goals, and governance on the techno-economic results are discussed.

As measures such as increased sorting of food waste and decreased plastic packaging content trade into effect, the composition of the MSW in Sweden is expected to change. However, the changes in the fuel properties of MSW due to this change are expected to be small. Initial techno-economic evaluations have revealed that producing methanol as a platform chemical through MSW gasification or waste-to-energy followed by CCU has great potential in Sweden.

Understanding how to improve the properties of post-consumer high density polyethylene recyclate

Tom O McDonald
Department of Materials and Department of Chemistry, University of Manchester, UK

As the demand for sustainable packaging grows, the use of post-consumer resin (PCR) high-density polyethylene (HDPE) faces challenges due to its often-inferior performance compared to virgin HDPE. This talk presents two studies addressing this issue. The first study evaluates eight candidate additives for enhancing the mechanical properties of two commercially available recycled HDPE PCRs. Extrusion blow moulding trials highlight the role of strain hardening modulus as a crucial criterion for pilot-scale trials. Results underscore the potential success of polyolefin additives over particulate additives in improving PCR HDPE performance. The second study focuses on selecting suitable PCR for applications, presenting the most extensive characterisation of HDPE PCR to date. A dataset of 23 HDPE resins, including 3 virgin and 20 PCR samples, undergoes comprehensive analysis using FTIR, DSC, TGA, rheology, colour analysis, and mechanical testing. Data science is applied to create a feature-rich dataset, demonstrating the effectiveness of combining FTIR, TGA, and mechanical testing in identifying PCRs closely matching the properties of virgin HDPE. This pipeline provides a robust methodology for assessing new PCRs as replacements for virgin plastic in specific applications, advancing sustainable packaging in the industry.

TABLE CONTENT

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